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Cheng et al.

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(54) **CHILD SAFETY SEAT ASSEMBLIES**

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Related U.S. Application Data

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(60) Provisional application No. 61/560,808, filed on Nov. 17, 2011.

(51) **Int. Cl.**

B60N 2/42	(2006.01)
B60N 2/28	(2006.01)
B60N 2/427	(2006.01)
B60N 2/68	(2006.01)

(52) **U.S. Cl.**

CPC ***B60N 2/2884*** (2013.01); ***B60N 2/2821*** (2013.01); ***B60N 2/2887*** (2013.01); ***B60N 2/42709*** (2013.01); ***B60N 2/43*** (2013.01); ***B60N 2/682*** (2013.01)

(58) **Field of Classification Search**

CPC B60N 2/43; B60N 2/682; B60N 2/884; B60N 2/887; B60N 2/2821; B60N 2/42709; B60N 2/2884; B60N 2/2887

See application file for complete search history.

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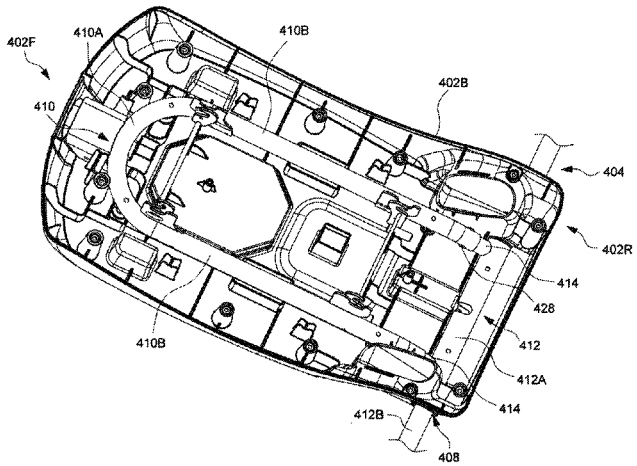
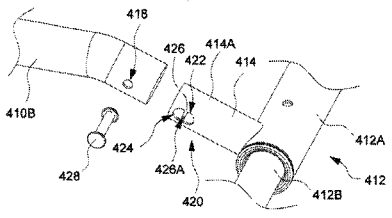
(57) **ABSTRACT**

A support base for a child safety seat includes a shell body affixed with an anchor structure, an arm extending transversally relative to the shell body and having a rod pivotally disposed through a tube portion, the tube portion having an extension connected with a side segment of the anchor structure, two latch assemblies respectively connected with a left and a right end of the rod for fixedly attaching the shell body with an anchorage fixture of a vehicle, and a cushion structure for cushioning a displacement of the shell body and the anchor structure relative to the arm and the latch assemblies when car collision occurs. The cushion structure is arranged adjacent to a joint region where the side segment and the extension are connected with each other, or in the base between the tube portion and an inner sidewall of the shell body.

16 Claims, 21 Drawing Sheets





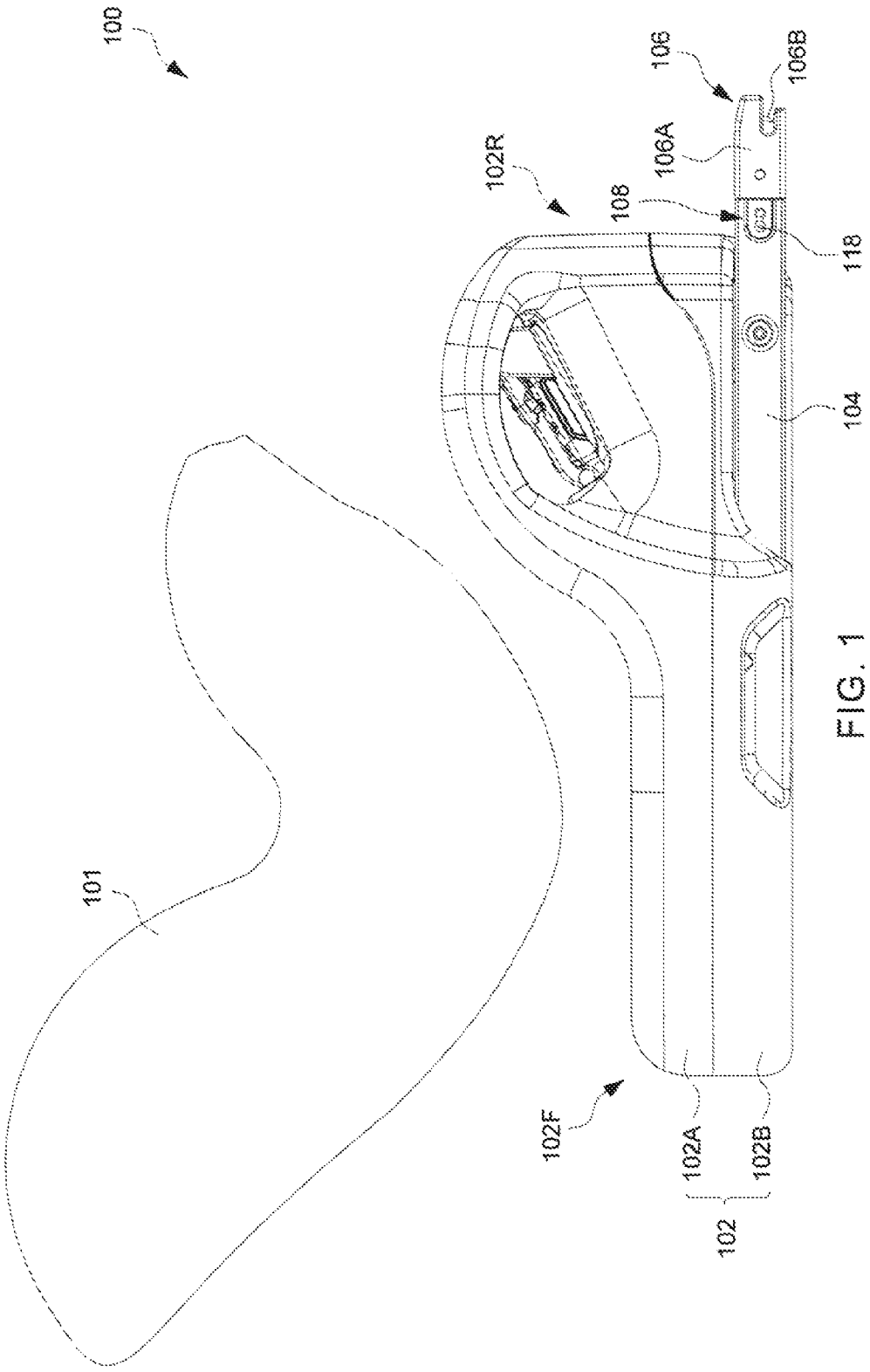
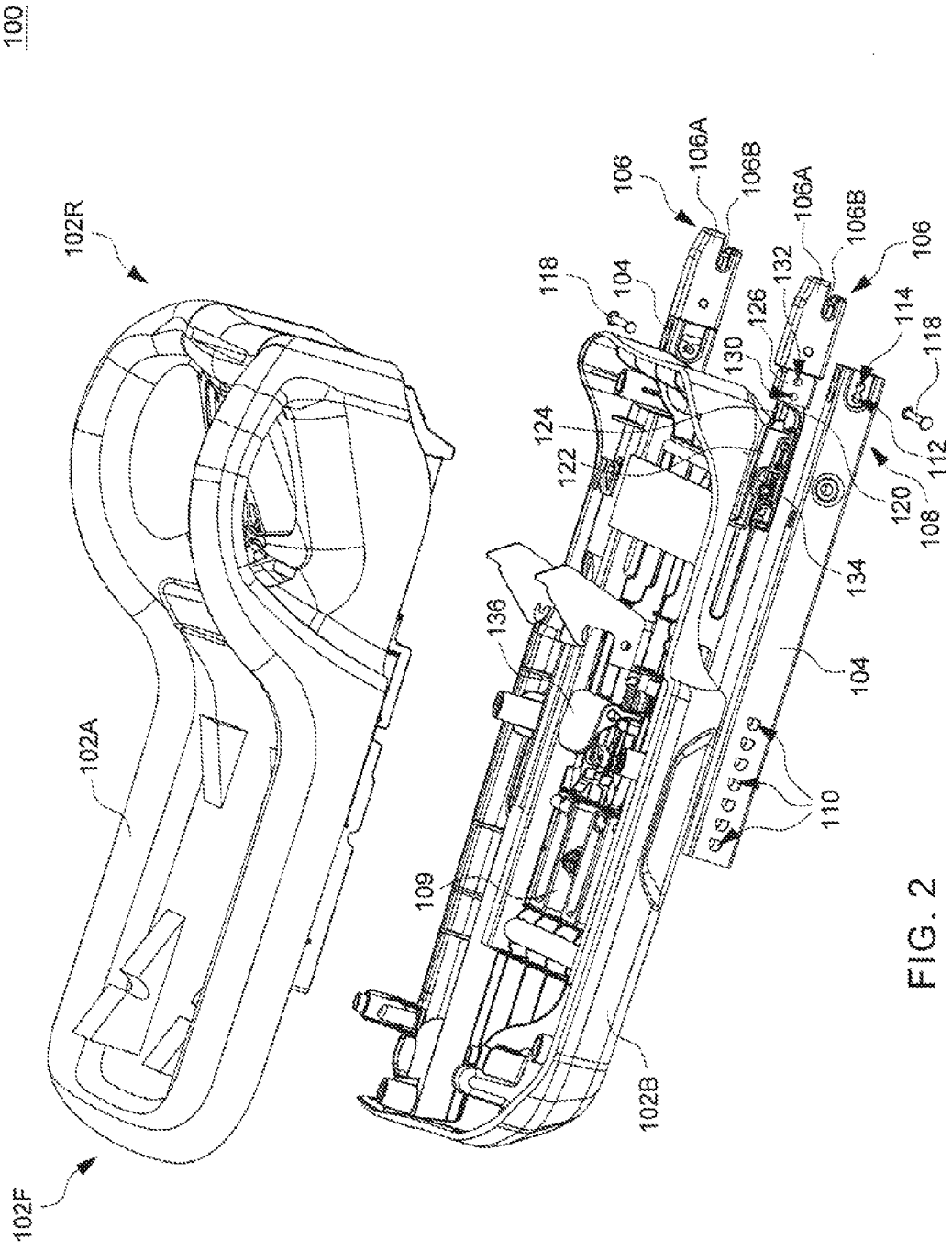


FIG. 1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102R
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102F
102B
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106A
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136
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110

FIG. 2

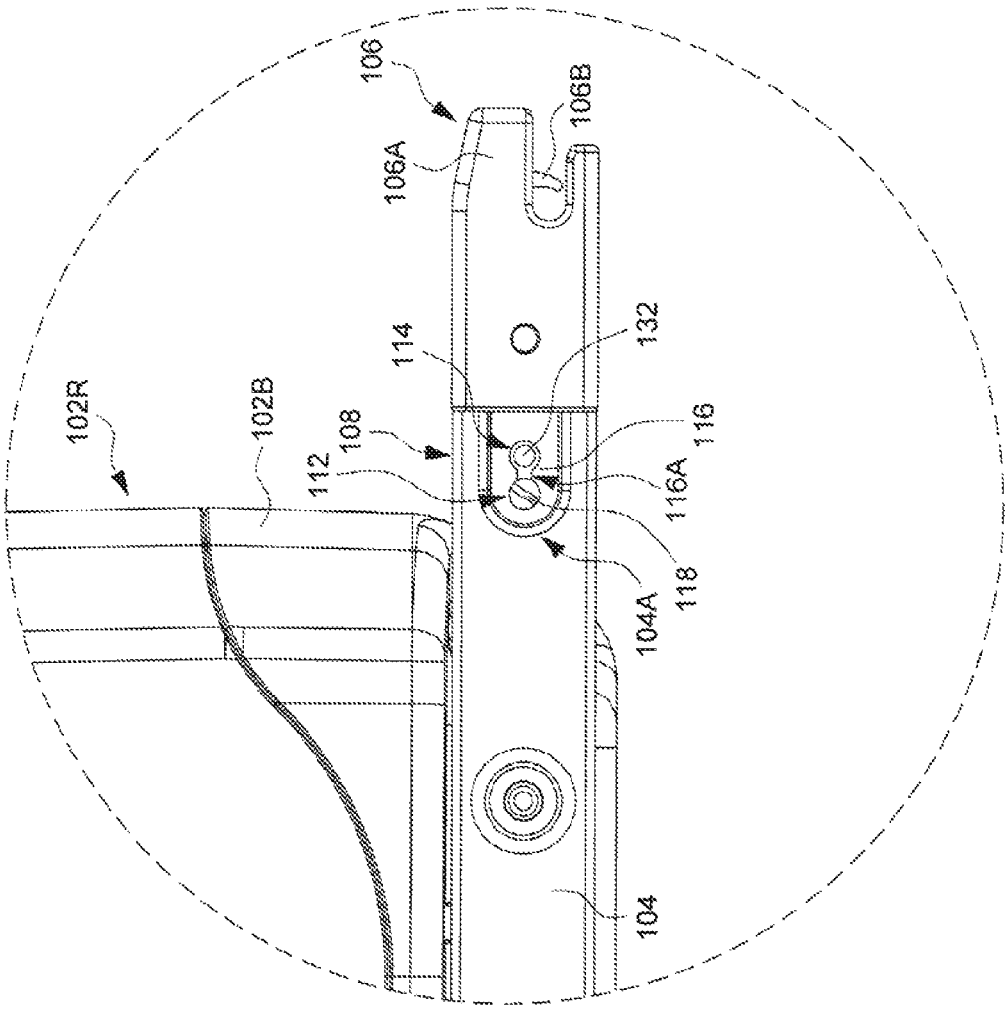
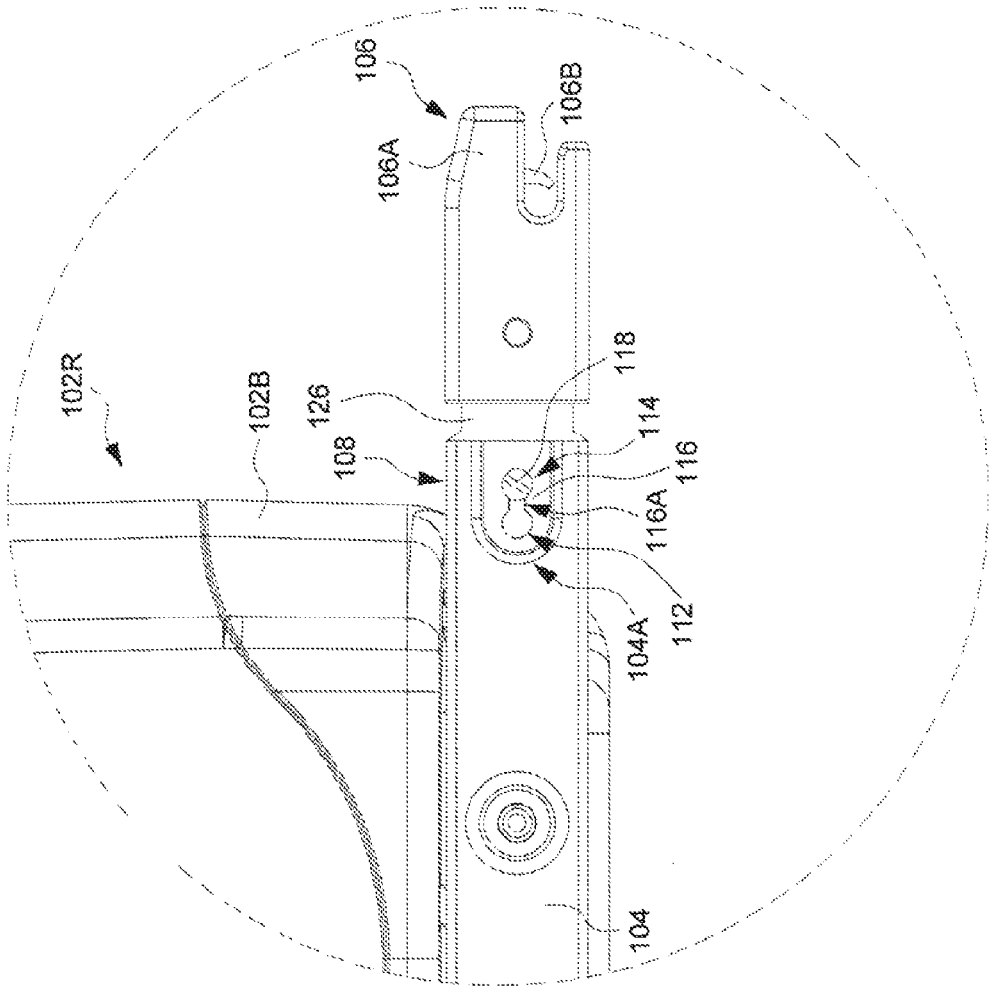


FIG. 3



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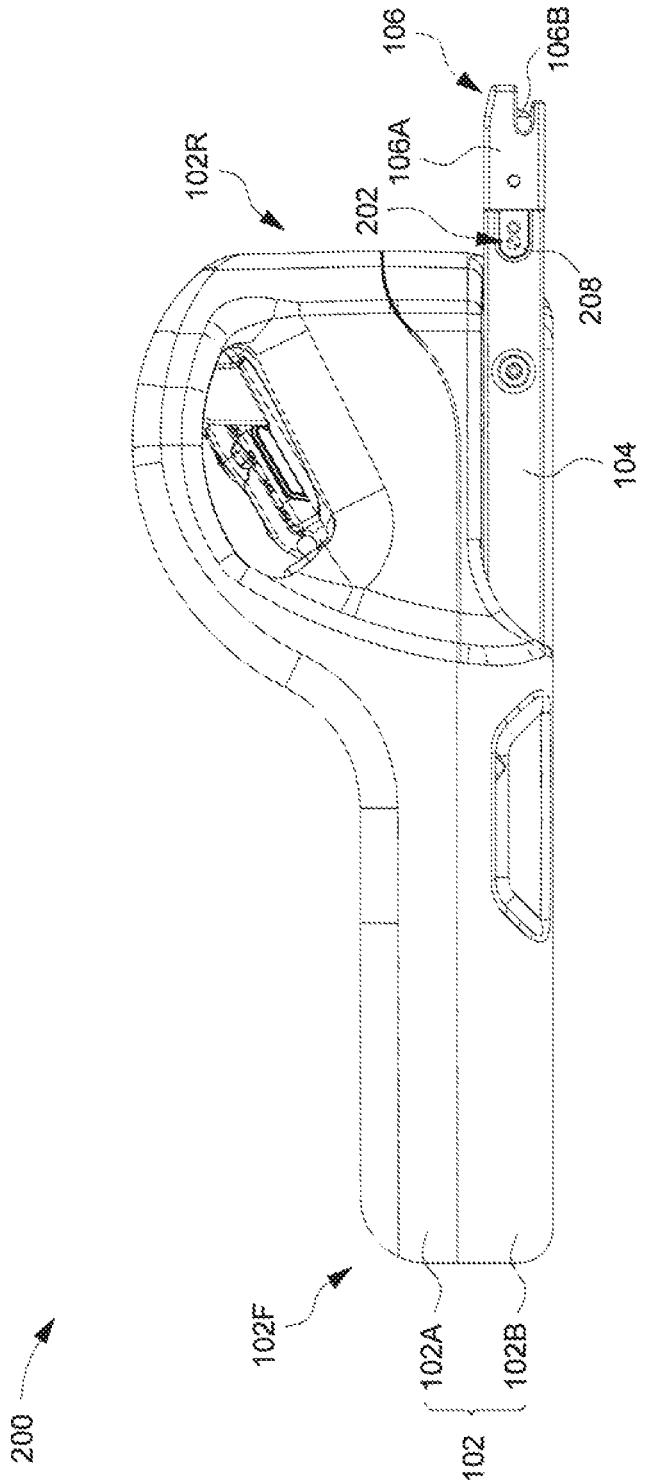


FIG. 5

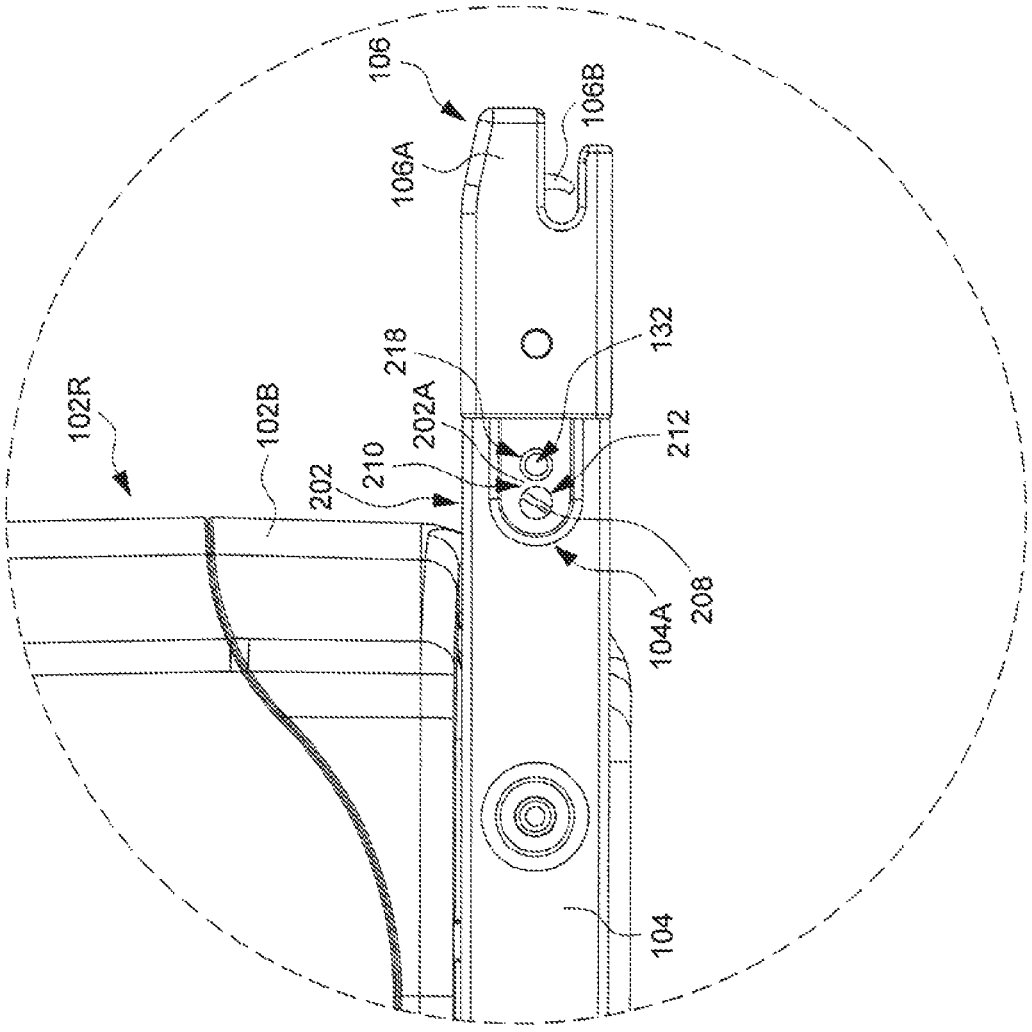


FIG. 6

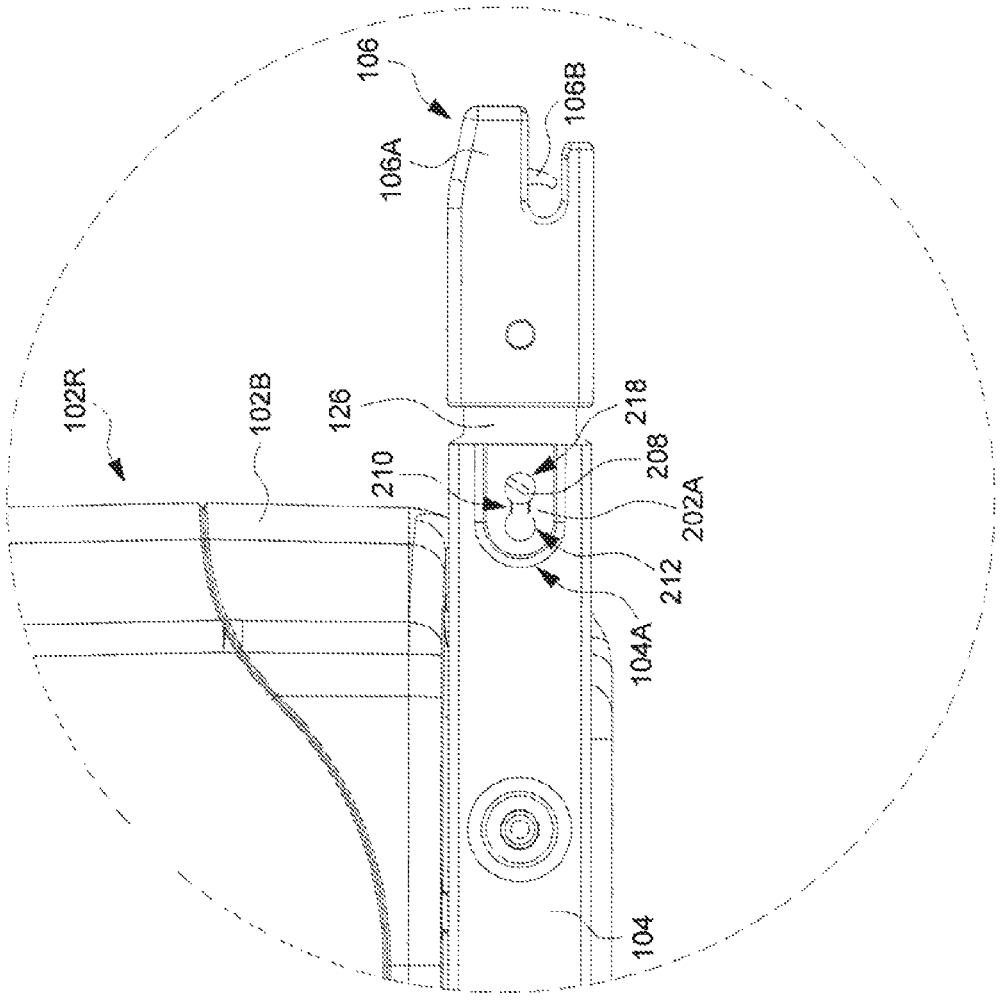
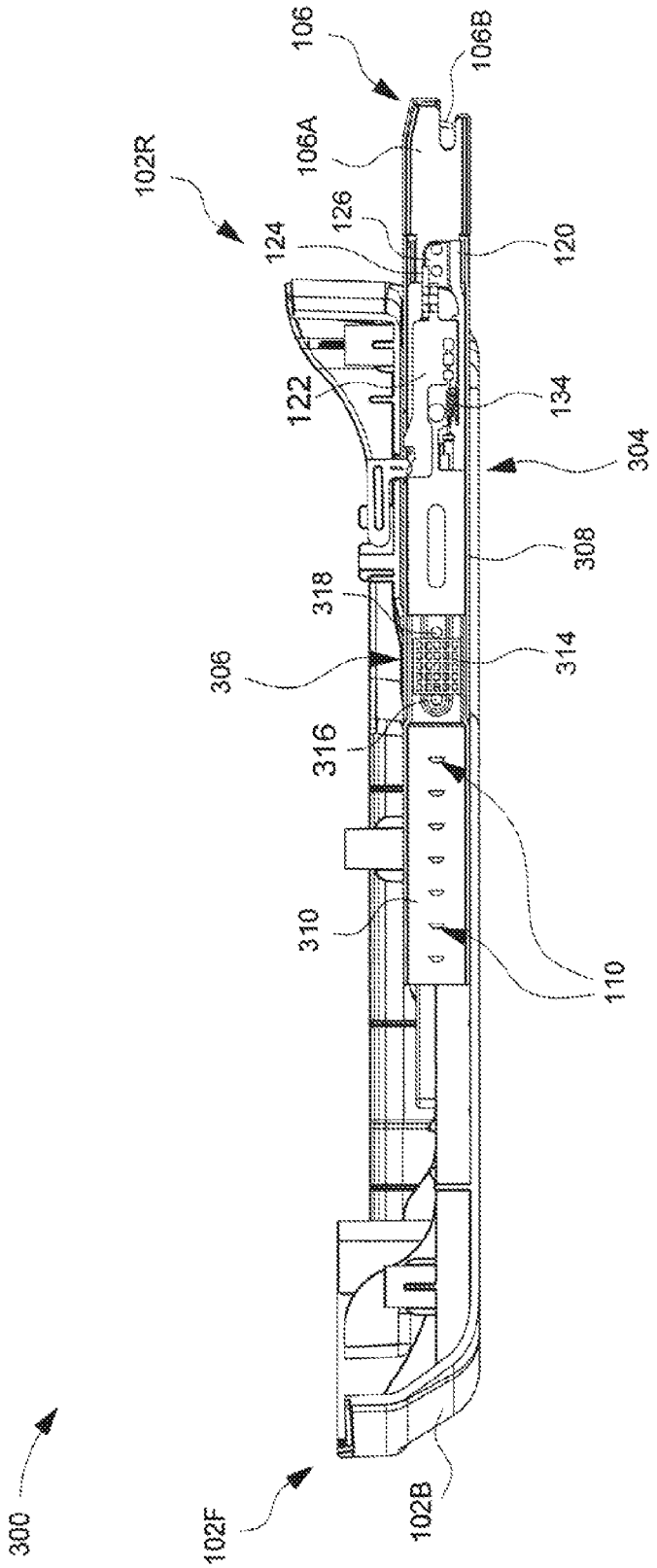


FIG. 7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106B
106A
102R
126
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102F
102B

FIG. 8

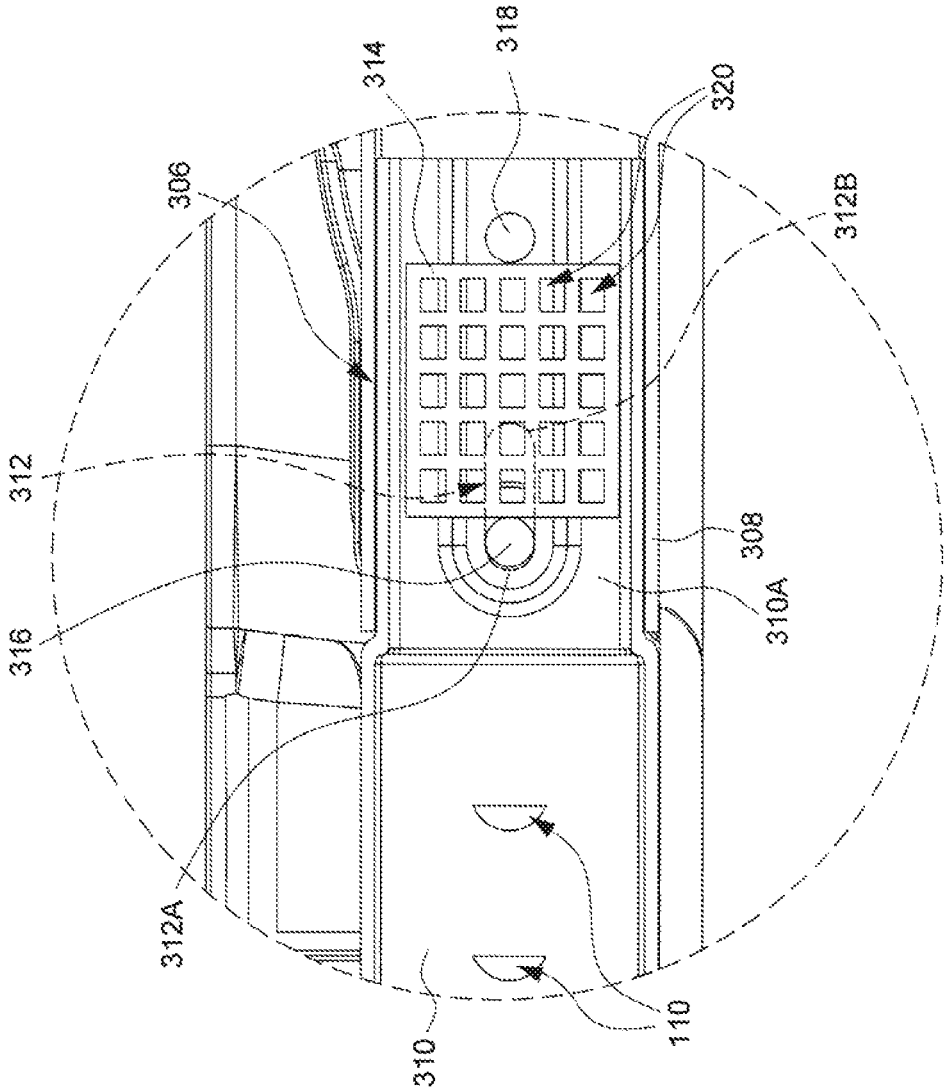


FIG. 9

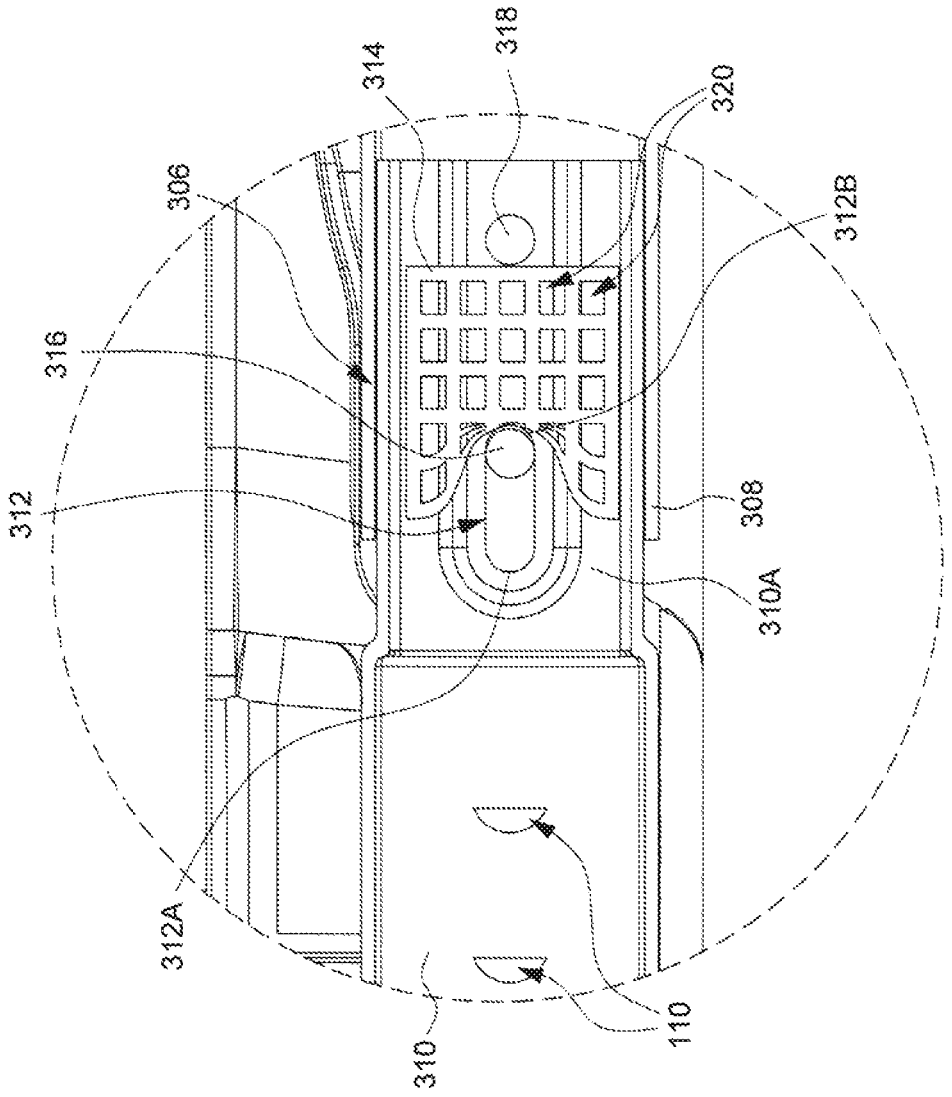
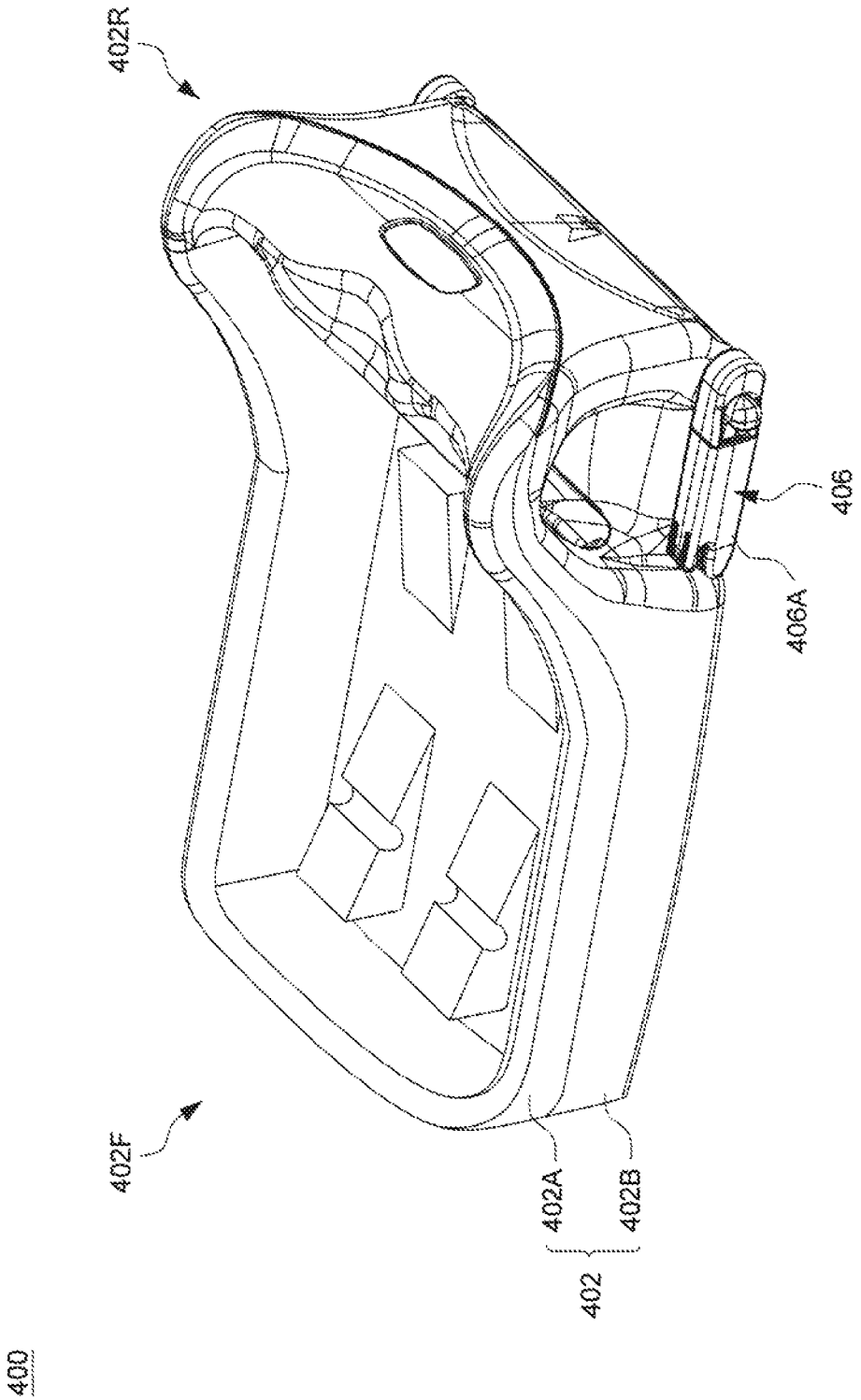


FIG. 10



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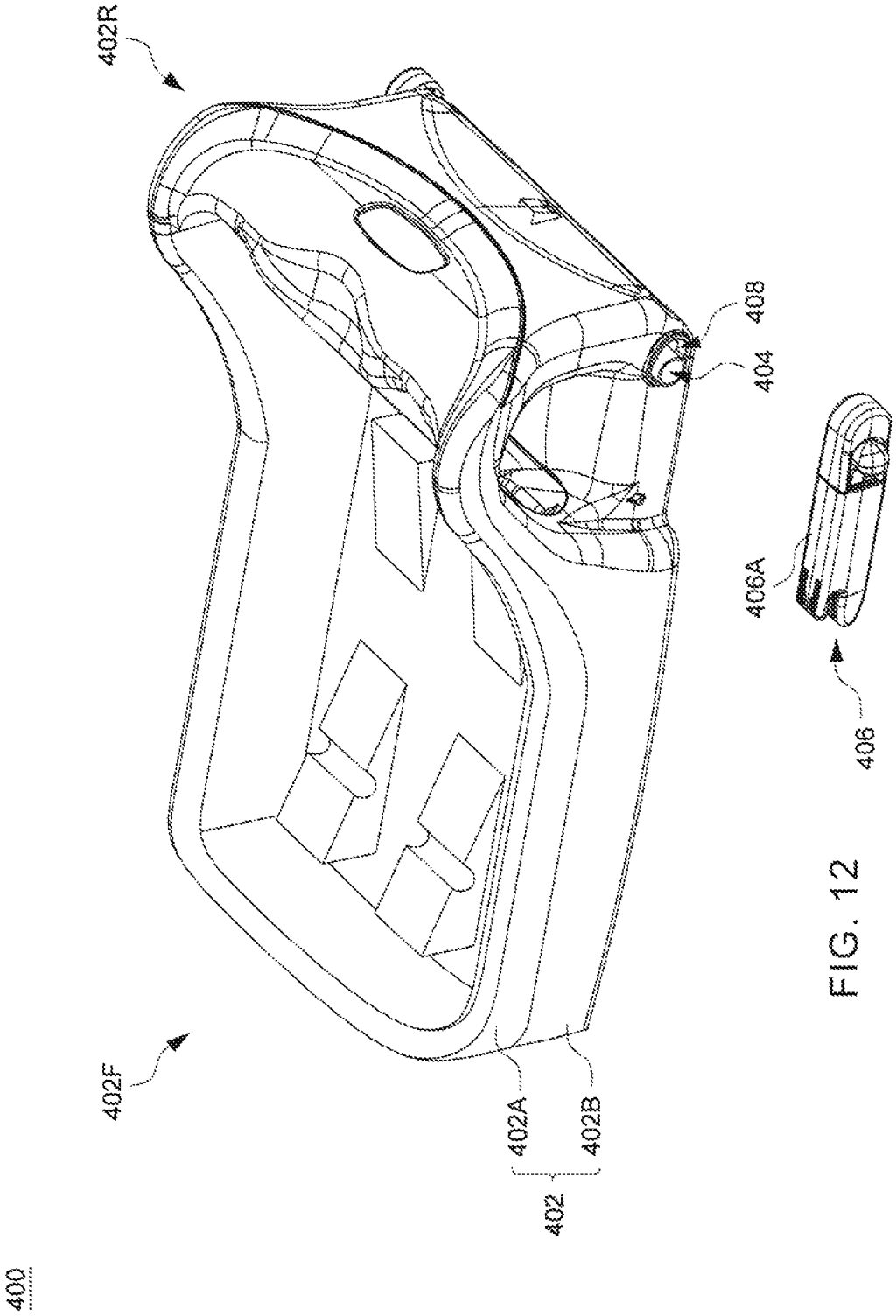

FIG. 12

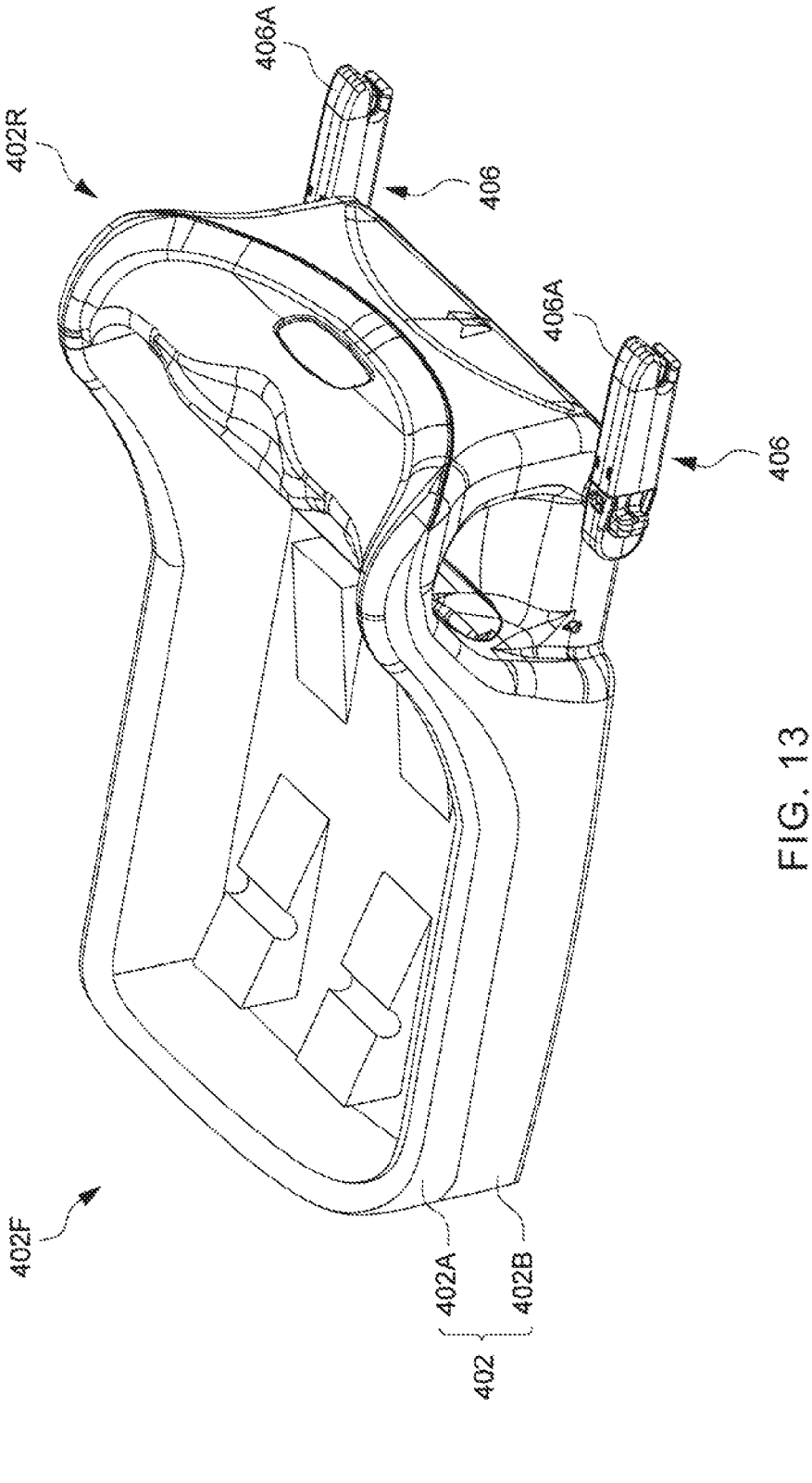

FIG. 13

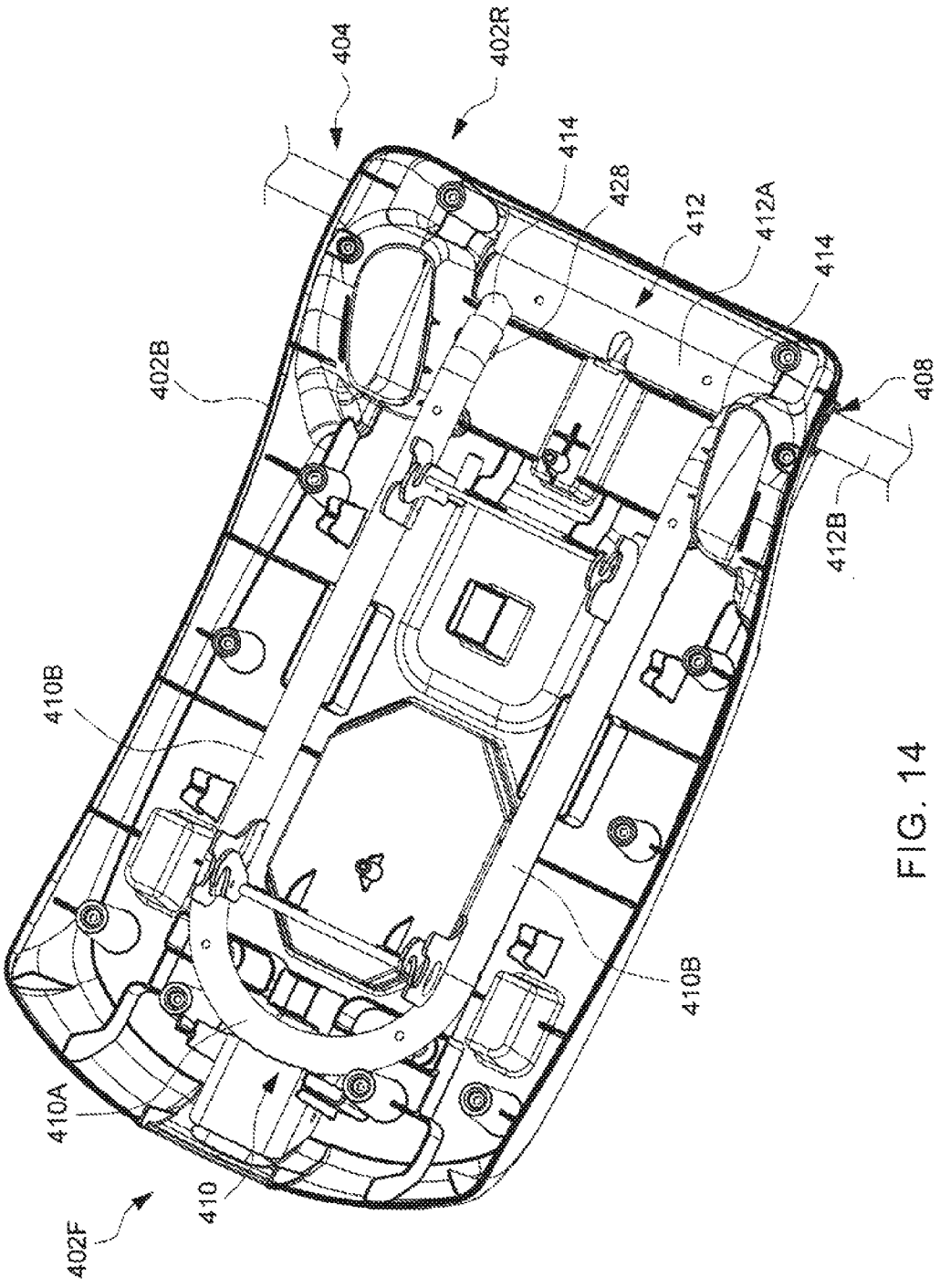
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FIG. 14

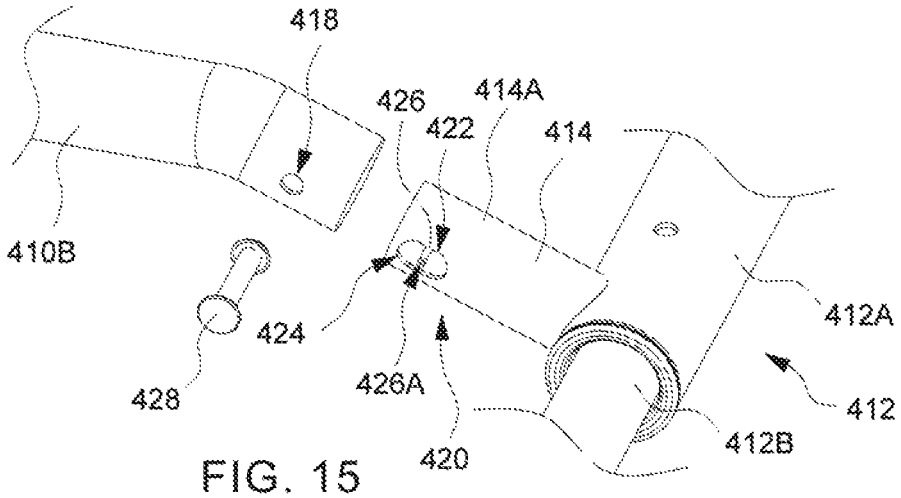


FIG. 15

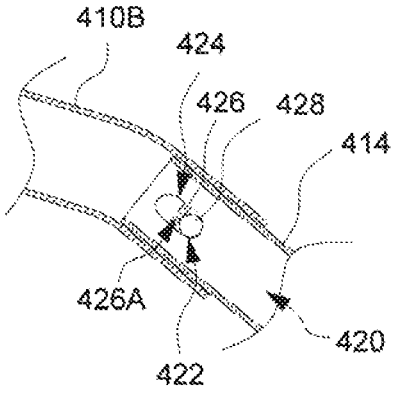


FIG. 16

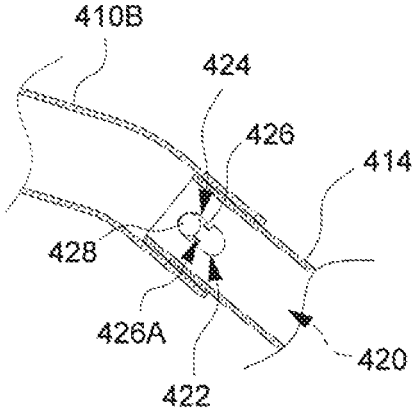


FIG. 17

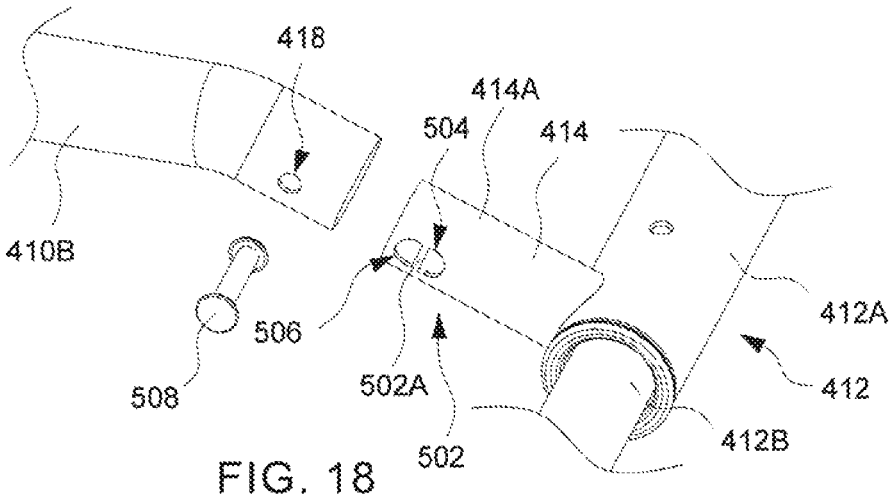


FIG. 18

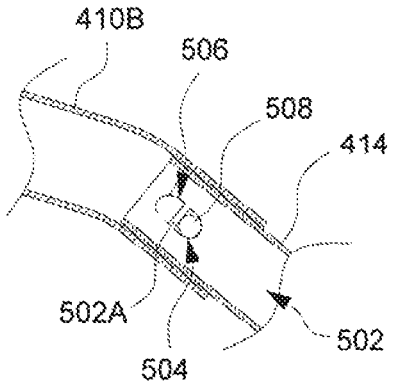


FIG. 19

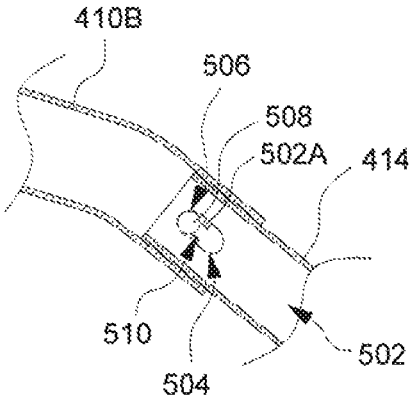
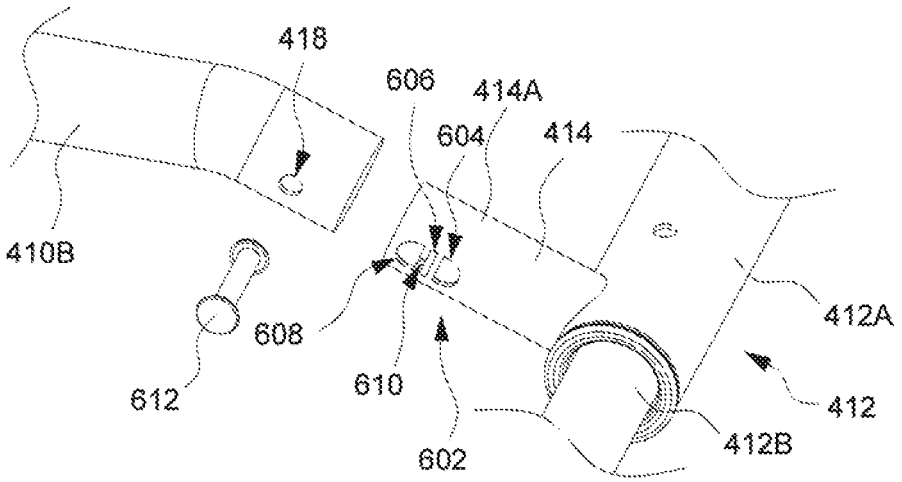


FIG. 20



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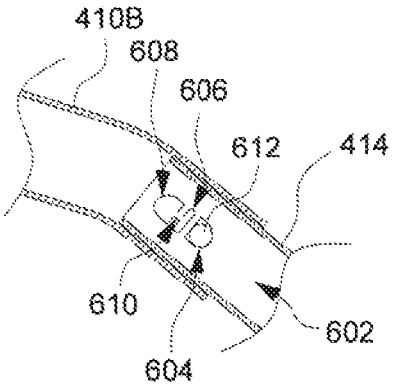

FIG. 22

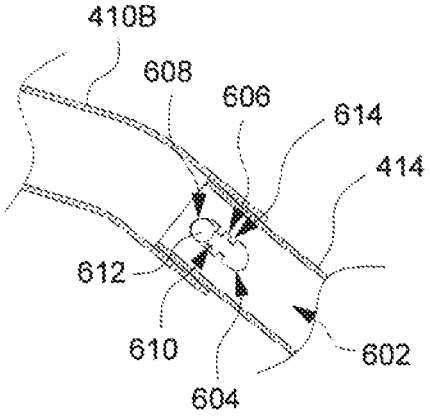

FIG. 23

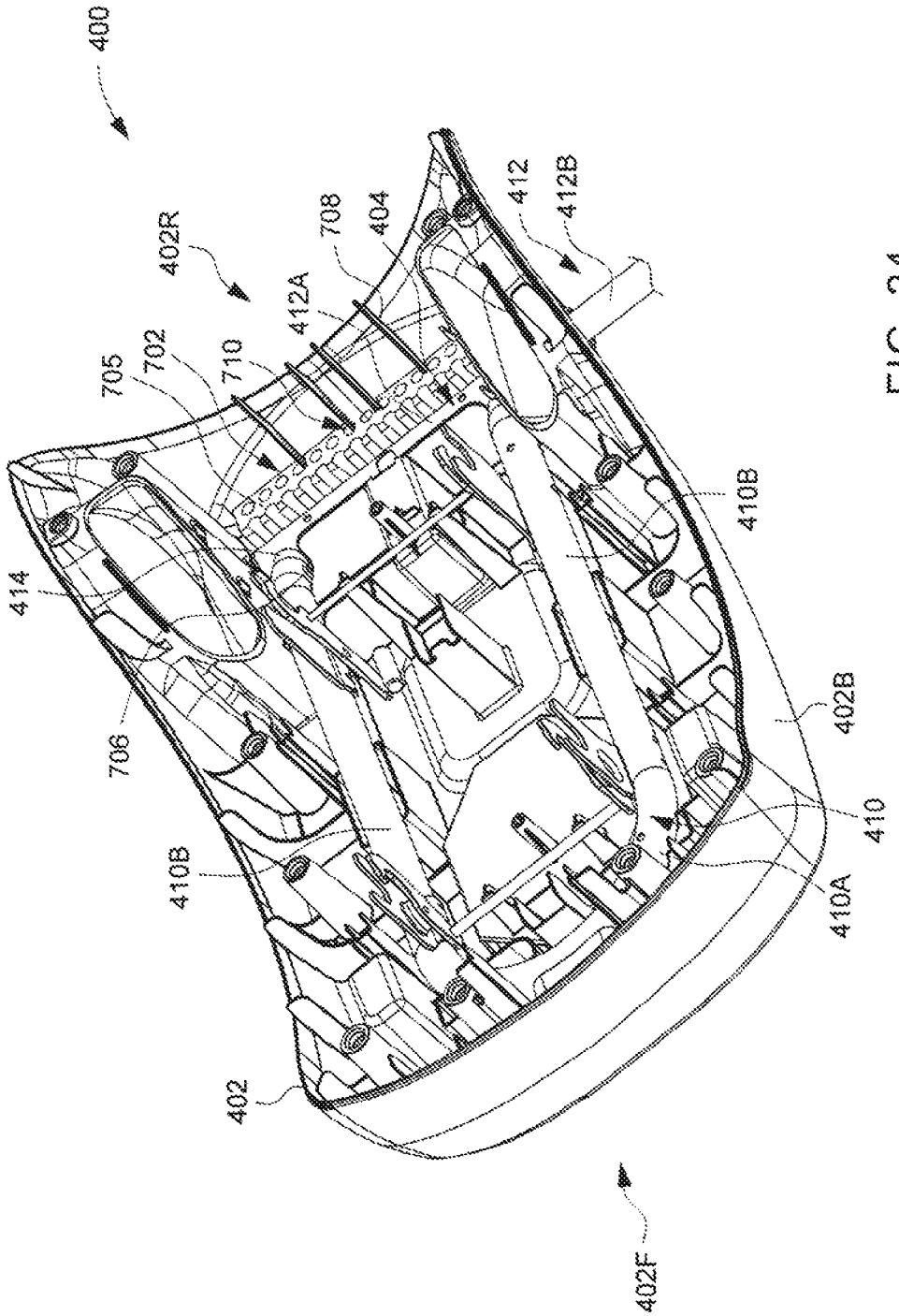
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FIG. 24

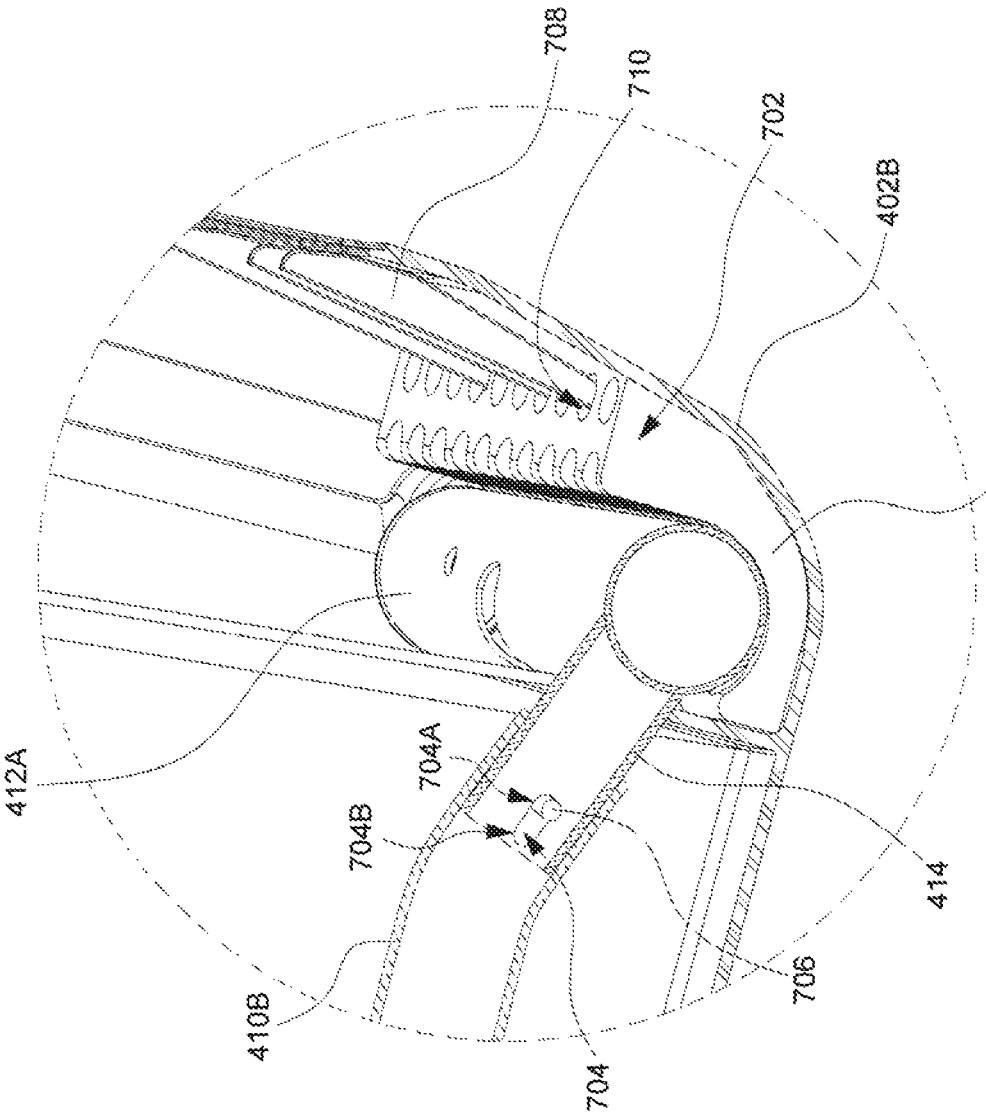

FIG. 25

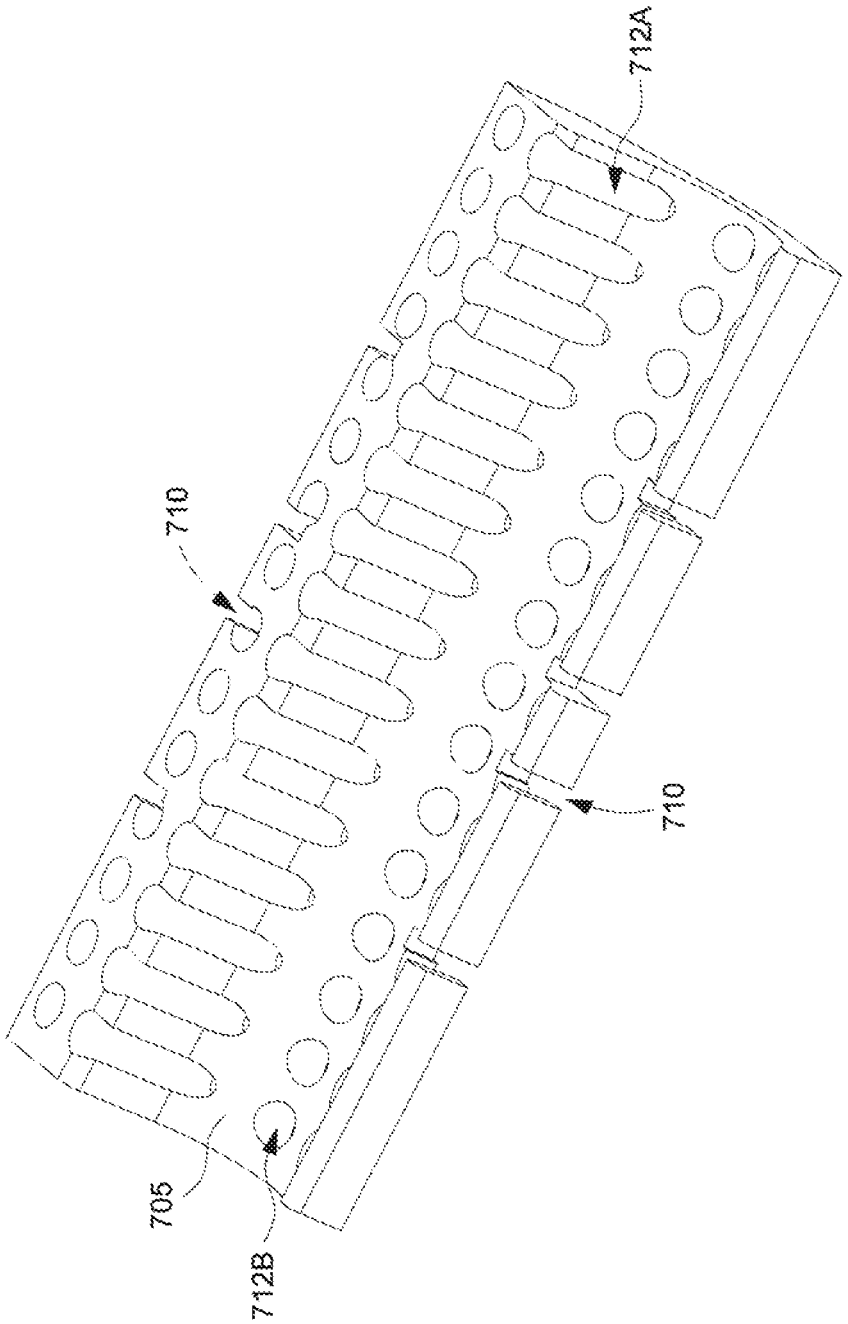

FIG. 26

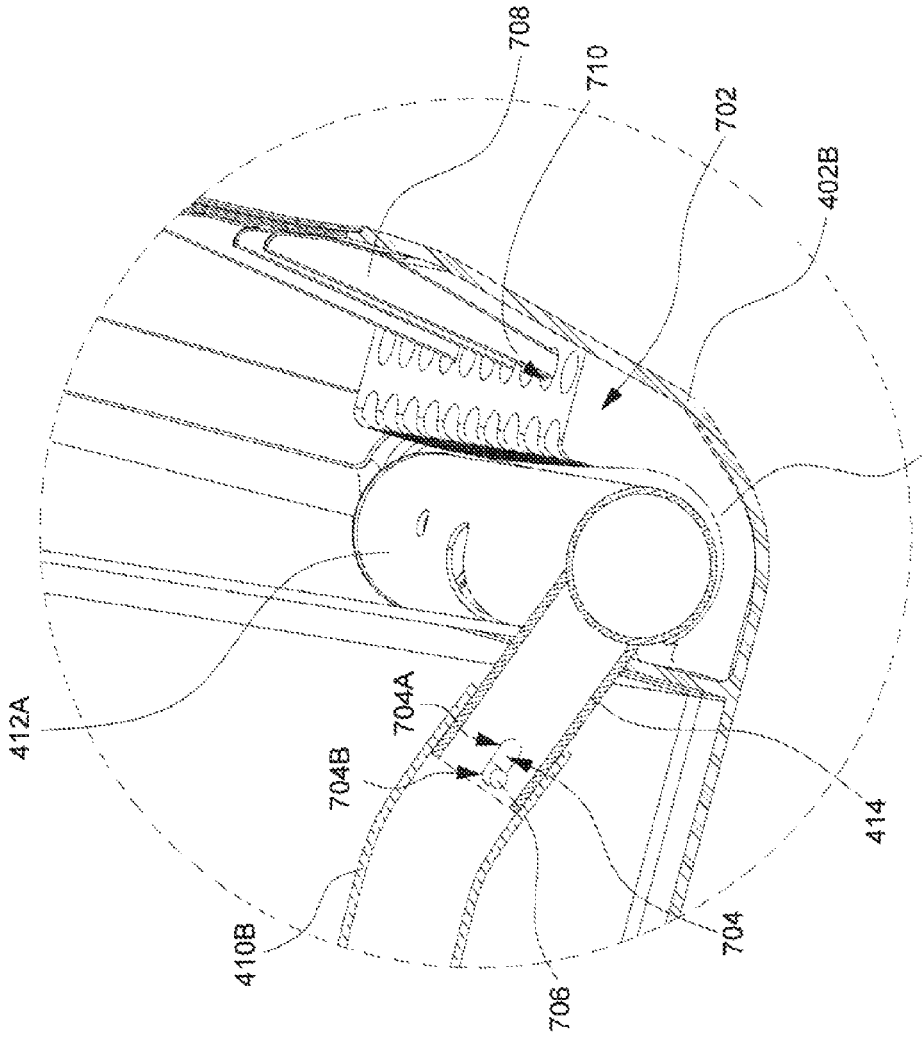

FIG. 27

CHILD SAFETY SEAT ASSEMBLIES

CROSS-REFERENCE TO RELATED APPLICATION(S)

This patent application is a continuation of U.S. patent application Ser. No. 13/678,688 filed on Nov. 16, 2012, which claims priority to U.S. Provisional Patent Application No. 61/560,808 filed on Nov. 17, 2011, both of which are incorporated herein by reference.

BACKGROUND

1. Field of the Invention

The present inventions relate to child safety seat assemblies.

2. Description of the Related Art

A child safety seat is usually required to seat a young child in a vehicle for protecting the child during crash collision. The child safety seat can be attached on the vehicle passenger's seat with the seatbelt of the vehicle. However, the use of the seatbelt for fastening the child safety seat may be inconvenient, and result in erroneous installation that fails to protect the child during collision.

Another approach proposes to incorporate a standardized latch system (i.e., ISOFIX standard) in the child safety seat through which the seat can be securely attached with an anchorage fixture provided in the vehicle. Because the ISOFIX latch system provides a tight hold of the child safety seat, the energy resulting from a crash collision may be substantially transmitted to the child and cause injury.

Therefore, there is a need for a child safety seat that can address at least the aforementioned issues.

SUMMARY

The present application describes child safety seat assemblies that include a support base, and a child safety seat arranged on the support base. In one embodiment, the support base includes a shell body, an arm extending transversally relative to the shell body, two latch assemblies and a cushion structure. The shell body has an inner sidewall, and an interior affixed with an anchor structure, the anchor structure including a side segment. The arm has a tube portion, and a rod arranged through the tube portion, the tube portion including an extension connected with the side segment of the anchor structure. The two latch assemblies are respectively connected with a left and a right end of the rod, the latch assemblies being operable to fixedly attach the shell body with an anchorage fixture of a vehicle, and the rod being rotatable relative to the tube portion to turn the two latch assemblies to either of a storage state and a deployed state. The cushion structure is arranged adjacent to a joint region where the side segment and the extension of the tube portion are connected with each other, or in the support base at a position between the tube portion and the inner sidewall of the shell body, the cushion structure being operable to cushion a displacement of the shell body and the anchor structure relative to the arm and the latch assemblies when a car collision occurs.

In other embodiments, the support base for a child safety seat includes a shell body having an interior affixed with an anchor structure, an arm extending transversally relative to the shell body, two latch assemblies operable to fixedly attach the shell body with an anchorage fixture of a vehicle, and a cushion structure. The arm has a rod pivotally supported through a tube portion, the tube portion including an extension connected with a side segment of the anchor structure. The two latch assemblies are respectively connected with a left and a right end of the rod, the rod being rotatable with the two latch assemblies relative to the tube portion. The cushion structure interacts with the arm to cushion a displacement of the shell body and the anchor structure relative to the arm and the latch assemblies when a car collision occurs.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic view illustrating an embodiment of a support base for a child safety seat;

FIG. **2** is a schematic view illustrating a construction of the support base shown in FIG. **1**;

FIG. **3** is an enlarged view illustrating one cushion structure shown in FIG. **2**;

FIG. **4** is a schematic view illustrating an operation of the cushion structure provided in the support base of FIG. **1** when installed in a vehicle;

FIG. **5** is a schematic view illustrating a second embodiment of a support base for a child safety seat;

FIG. **6** is an enlarged view illustrating a cushion structure provided in the support base shown in FIG. **5**;

FIG. **7** is a schematic view illustrating exemplary operation of the cushion structure shown in FIG. **6** when the support base is installed in a vehicle;

FIG. **8** is a schematic view illustrating a third embodiment of a support base for a child safety seat;

FIG. **9** is an enlarged view illustrating a cushion structure provided in the support base shown in FIG. **8**;

FIG. **10** is a schematic view illustrating exemplary operation of the cushion structure shown in FIG. **9** when the support base is installed in a vehicle;

FIG. **11** is a perspective view illustrating a fourth embodiment of a support base for a child safety seat;

FIG. **12** is a schematic view illustrating a latch assembly detached from the support base shown in FIG. **11**;

FIG. **13** is a perspective view illustrating the support base shown in FIG. **11** with the latch assemblies in a deployed state;

FIG. **14** is a schematic view illustrating an interior of the shell body of the base shown in FIG. **11**;

FIG. **15** is an exploded view illustrating the assembly of a tubular anchor with an arm in the shell body shown in FIG. **14**;

FIG. **16** is a partial cross-sectional view illustrating the tubular anchor shown in FIG. **15** assembled with the arm;

FIG. **17** is a schematic view illustrating exemplary operation of the cushion structure shown in FIG. **15** when the support base is installed in a vehicle;

FIG. **18** is a schematic view illustrating another cushion structure that can be used in the support base shown in FIG. **11**;

FIG. **19** is a schematic view illustrating the cushion structure of FIG. **18** disposed adjacent to a joint region of a tubular anchor with an arm in the support base;

FIG. **20** is a schematic view illustrating exemplary operation of the cushion structure shown in FIG. **19** when the support base is installed in a vehicle;

FIG. **21** is a schematic view illustrating another cushion structure that can be used in the support base shown in FIG. **11**;

FIG. **22** is a schematic view illustrating a cushion structure shown in FIG. **21** disposed adjacent to a joint region of a tubular anchor with an arm in the support base;

FIG. **23** is a schematic view illustrating exemplary operation of the cushion structure shown in FIG. **22** when the support base is installed in a vehicle;

FIG. **24** is a perspective view illustrating another variant cushion structure that can be used in the support base shown in FIG. **11**;

FIG. **25** is a partially enlarged view illustrating the assembly of the cushion structure shown in FIG. **24**;

FIG. **26** is a perspective view of a cushioning pad of the cushion structure shown in FIG. **25**; and

FIG. **27** is a schematic view illustrating exemplary operation of the cushion structure shown in FIG. **25** when the support base is installed in a vehicle.

DETAILED DESCRIPTION OF THE EMBODIMENTS

The present application describes child safety seat assemblies that include a support base, and a child safety seat arranged on the support base. In one embodiment, the support base includes a shell body, a latch assembly operable to fixedly attach the shell body with an anchorage fixture of a vehicle, and a cushion structure coupled with the shell body, wherein the cushion structure is operable to allow a cushioned displacement of the shell body relative to the latch assembly when the child safety seat is subject to collision.

FIG. **1** is a schematic view illustrating an embodiment of a support base **100** for a child safety seat, and FIG. **2** is a schematic view illustrating a construction of the base **100**. The support base **100** can include a shell body **102**, and two adjustable arms **104** having distal ends respectively provided with latch assemblies **106** and cushion structures **108**. The shell body **102** can be formed from the assembly of upper and lower housing parts **102**A and **102**B, and have a rear **102**R and a front **102**F. The upper housing part **102**A can have an upper outward surface having a construction adapted to detachably support a child safety seat **101**.

The adjustable arms **104** can be movably assembled through the shell body **102** transversally spaced apart from each other, and can be movable along a lengthwise axis of the shell body **102** that extends from the rear **102**R to the front **102**F. A portion of the arms **104** away from the end where the latch assembly **106** is mounted can include a plurality of locking openings **110** disposed along the lengthwise axis of the shell body **102**. The interior of the shell body **102** may also include at least one locking member (not shown) movable transversally to engage with and disengage from any one of the locking openings **110** to lock the arms **104** in place. Accordingly, the arms **104** can be operable to adjust a length at which the latch assemblies **106** extend from the rear **102**R of the shell body **102**. An actuator mechanism **109** may be operable to unlock the arms **104**.

The two latch assemblies **106** can be respectively arranged adjacent to the distal ends of the two arms **104**, and can be operable to lock and unlock with respect to an anchorage fixture provided in a vehicle. Each latch assembly **106** can include an outer casing **106**A that can enclose a locking hook **106**B.

For operating the latch assemblies **106**, each of the arms **104** can have an interior in which an extension **120**, a sliding part **122** having a projection **124**, and a bracket **126** can be installed. The bracket **126** can be affixed with the latch assembly **106**, in particular with the outer casing **106**A of the latch assembly **106**. The extension **120** can be affixed with the outer casing **106**A of the latch assembly **106**, and protrude forward from the bracket **126** along the lengthwise axis of the arm **104**. The bracket **126** can have a sidewall provided with two holes **130** and **132** spaced apart from each other along the lengthwise axis of the arm **104**. A spring **134** can be connected between the sliding part **122** and the extension **120**. The projection **124** fixedly joined with the sliding part **122** can be disposed through the bracket **126** and through the interior of the outer housing **106**A. An actuator mechanism **136** may be assembled with the lower housing part **102**B, and can be coupled with the sliding parts **122** via transmission cables (not shown). The actuator mechanism **136** can be operable to switch the locking hooks **106**B from a locking state to an unlocking state for permitting detachment of the support base **100** from the anchorage fixture of the vehicle.

FIG. **3** is an enlarged view illustrating one cushion structure **108** shown in FIG. **2**. The cushion structures **108** can be disposed symmetrically adjacent to the two adjustable arms **104**, and have a same construction. The cushion structures **108** can be coupled with the shell body **102**, and are configured to allow a cushioned displacement of the shell body **102** relative to the latch assemblies **106** when collision occurs. Each cushion structure **108** can include a rear portion **104**A of each arm **104** having two holes **112** and **114** that are separated from each other via a solid cushioning portion **116** having a slit **116**A. The cushioning portion **116** can be made of the material of the arm **104**, and is located adjacent to the holes **112** and **114**. The holes **112** and **114** may be located in a region of the adjustable arm **104** adjacent to the outer housing **106**A of the latch assembly **106**, and may be spaced apart from each other along the lengthwise axis of the arm **104**. The slit **116**A can be connected between the two holes **112** and **114**, and is narrower than the holes **112** and **114**. A fastener such as a rivet **118** can be respectively engaged through the hole **112** of the arm **104** and the hole **130** of the bracket **126** to affix the bracket **126** with the arm **104** associated therewith. The rivet **118** passing through the hole **112** can be in contact with the cushioning portion **116**.

FIG. **4** is a schematic view illustrating an operation of the cushion structure **108** when the support base **100** is installed in a vehicle. In case the vehicle is subject to a sudden colliding force parallel to the lengthwise axis of the shell body **102** (e.g., when the collision occurs at the front of the vehicle), the inertia of the support base **100** may cause the shell body **102** and the arms **104** to displace away from the attachment points of the latch assemblies **106** with the anchorage fixture of the vehicle. As a result, each rivet **118** affixed with one associated latch assembly **106** can be urged to push against the cushioning portion **116**, and move from the hole **112** through the cushioning portion **116** to the hole **114**. In particular, the shaft portion of the rivet **118** can have a diameter that is slightly larger than the slit **116**A, which causes deformation (e.g., plastic deformation) of the slit **116**A for absorbing a part of the collision energy as the rivet **118** moves from the hole **112** to the hole **114**. This cushioned displacement of the shell body **102** and the arms **104** relative to the latch assemblies **106** can dissipate a part of the collision energy to reduce the risk of injury to the child.

FIG. **5** is a schematic view illustrating a second embodiment of a support base **200** for a child safety seat. The support base **200** can include a shell body **102**, adjustable arms **104** and latch assemblies **106** like previously described. One difference lies in the design of the cushion structures **202** (only one is shown in FIG. **5**) that are provided symmetrically on the two arms **104** adjacent to the latch assemblies **106**.

FIG. **6** is an enlarged view illustrating one cushion structure **202**. The cushion structure **202** can include the rear portion **104**A of one arm **104** having two spaced-apart holes **212** and **218** that are disposed along the lengthwise axis of the arm **104** and are isolated from each other via a cushioning portion **202**A. The cushioning portion **202**A can be made of the same material of the arm **104**, and is located adjacent to the holes **212** and **218**. A fastener such as rivet **208** can be

respectively engaged through the hole **204** of the arm **104** and the hole **130** of the bracket **126** (as better shown in FIG. **2**) to affix the bracket **126** with the arm **104** associated therewith. The rivet **208** passing through the hole **204** can be in contact with the cushioning portion **202**A.

FIG. **7** is a schematic view illustrating exemplary operation of the cushion structure **202** when the support base **200** is installed in a vehicle. In case the vehicle is subject to a sudden colliding force parallel to the lengthwise axis of the shell body **102** (e.g., when the collision occurs at the front of the vehicle), the inertia of the support base **100** may cause the shell body **102** and the arms **104** to displace away from the attachment points of the latch assemblies **106** with the anchorage fixture of the vehicle. As a result, the rivet **208** can be urged to push against and break at least partially the cushioning portion **202**A of the arm **104** between the holes **212** and **218**, and move from the hole **212** to the hole **218**. The break of the cushioning portion **202**A between the holes **212** and **218** may create a trench **210**, such that a portion of a collision energy can be dissipated. This cushioned displacement of the shell body **102** and the arms **104** relative to the latch assemblies **106** can dissipate a part of the collision energy to reduce the risk of injury to the child.

FIG. **8** is a schematic view illustrating a third embodiment of a support base **300**. The support base **300** can include the shell body **102**, and two adjustable arms **304** of a same construction including the latch assemblies **106** and cushion structures **306** (only one arm **304** with one cushion structure **306** is exemplary shown in FIG. **8**, the other one being similar in construction). Each of the arms **304** can include two hollow segments **308** and **310** that can be fixedly connected with each other by partially inserting into each other. The segment **308** can be affixed with the outer casing **106**A of the latch assembly **106**, and can have an interior through which the extension **120**, the sliding part **122** with the projection **124**, and the bracket **126** are respectively installed. The locking openings **110** can be distributed lengthwise along the segment **310**. The segment **310** can have a portion **310**A that is assembled through the interior of the segment **308**. The cushion structure **306** can be arranged adjacent to the portion **310**A.

FIG. **9** is an enlarged view illustrating the cushion structure **306**. The cushion structure **306** can include a cushioning pad **314** that is affixed in an overlapping region between the segments **310** and **308**. The segment **310** can include an elongated slot **312** that extends along the lengthwise axis of the arm **304** and has opposite first and second ends **312**A and **312**B. A rivet **316** can be fixedly engaged with the segment **308**, and assembled through the slot **312** adjacent to the first end **312**A. An abutment **318** can be affixed with the segment **310** adjacent to the second end **312**B of the slot **312**. The cushioning pad **314** can be exemplary made of cast aluminum, but any other deformable materials may also be suitable. Moreover, the cushioning pad **314** can also include a plurality of openings **320** to increase the ability of the cushioning pad **314** to deform. The cushioning pad **314** can be disposed between the rivet **316** and the abutment **318**, and can at least partially overlap with the slot **312**.

FIG. **10** is a schematic view illustrating exemplary operation of the cushion structure **306** when the support base **300** is installed in a vehicle. In case the vehicle is subject to a sudden colliding force parallel to the lengthwise axis of the shell body **102** (e.g., when the collision occurs at the front of the vehicle), the inertia of the support base **300** and the seat installed thereon may cause the shell body **102** and the arms **304** to displace away from the attachment points of the latch assemblies **106** with the anchorage fixture of the vehicle. Because the segment **308** is affixed with one associated latch assembly **106**, the segment **310** locked with the shell body **102** can urge the rivet **316** to move from the first end **312**A toward the second end **312**B of the slot **312**, which compresses the cushioning pad **314** for absorbing a part of the energy created by the collision. This cushioned displacement of the shell body **102** and the arms **304** relative to the latch assemblies **106** can absorb a part of the collision energy to reduce the risk of injury to the child. It will be appreciated that the cushioning pad **314** may also be used in combination with the cushion structures in any of the support bases described previously.

FIG. **11** is a perspective view illustrating a fourth embodiment of a support base **400** for a child safety seat, FIG. **12** is a schematic view illustrating a latch assembly **406** detached from the support base **400**, and FIG. **13** is a perspective view illustrating the support base **400** with the latch assemblies **406** in a deployed state. Referring to FIGS. **11-13**, the support base **400** can include a shell body **402** having a rear **402**R and a front **402**F, an elongated arm **404** extending transversally parallel to a width of the shell body **402**, and two latch assemblies **406** connected with the left and right ends of the arm **404**. The shell body **402** can be formed from the assembly of upper and lower housing parts **402**A and **402**B. The upper housing part **402**A can have an outer surface having a construction adapted to detachably support a child safety seat (not shown). The lower housing part **402**B can have left and right sides symmetrically provided with openings **408** adjacent to the rear **402**R of the base **402**. Two opposite end portions of the arm **404** can respectively extend through the openings **408**, and connect with the latch assemblies **406**. The size of the openings **408** may be larger than a cross-section of the two end portions of the arm **404**, so that a limited range of displacement of the arm **404** in the openings **408** is permitted. Each latch assembly **406** can include an outer casing **406**A that encloses various components of the latch assembly **406**.

In FIG. **11**, the support base **400** is shown in a configuration in which the latch assemblies **406** are folded toward the shell body **402** for facilitating storage of the support base **400**. In FIG. **13**, the support base **400** is shown in a configuration in which the latch assemblies **406** are deployed rearward for fastening with the anchorage fixture of a vehicle.

FIG. **14** is a schematic view illustrating an interior of the shell body **402**. The interior of the shell body **402** can be affixed with a tubular anchor **410** of a U-shape including a transversal segment **410**A and two side segments **410**B. The arm **404** can include a transversal segment **412**, and two transversally spaced-part extensions **414** projecting from an outer surface of the transversal segment **412**. The transversal segment **412** can include a tube portion **412**A, and a rod **412**B extending transversally through an interior of the tube portion **412**A. Two opposite ends of the rod **412**B can project outward from the left and right ends of the tube portion **412**A, and connect with the latch assemblies **406**. The rod **412**B can rotate within the tube portion **412**A to concurrently turn the two latch assemblies **406** to either of a storage state and a deployed state. The two extensions **414** can be fixedly joined with the tube portion **412**A symmetrically at left and right sides relative to a center of the tube portion **412**A, and can respectively affix with the side segments **410**B of the tubular anchor **410**.

FIG. **15** is an exploded view illustrating the assembly of the tubular anchor **410** with the arm **404**, and FIG. **16** is a partial cross-sectional view illustrating the tubular anchor **410** assembled with the arm **404**. The side segments **410**B of the tubular anchor **410** can have a cross-section that is larger than the extensions **414** in size. The extensions **414** can respec-

tively insert at least partially through the side segments **410**B for affixing the arm **404** with the tubular anchor **410**.

Each cushion structure **420** can be respectively disposed in the joint region between one side segment **410**B of the tubular anchor **410** and one extension **414** of the arm **404**. The cushion structure **420** can include a distal portion **414**A of the extension **414** having two holes **422** and **424**, and an adjacent cushioning portion **426** including a slit **426**A connected between the two holes **422** and **424**. The cushioning portion **426** can be made of the same material of the extension **414** or arm **404**. The slit **426**A can be narrower than the holes **422** and **424** in size. The holes **422** and **424** and the slit **426**A may be distributed along an axis of insertion of the extension **414** through the side segment **410**B.

Once the extension **414** is put in place through the associated side segment **410**B, a hole **418** formed through the side segment **410**B can be aligned with the hole **422** of the extension **414**. A fastener such as rivet **428** then can be engaged through the hole **418** of the side segment **410**B and the hole **422** of the extension **414** in contact with the cushioning portion **426** to fixedly fasten the tubular anchor **410** with the arm **404**. The rivet **428** can be greater than the size of the slit **426**A, so that the rivet **428** cannot easily move through the slit **426**A once it is engaged through the hole **422**.

FIG. **17** is a schematic view illustrating exemplary operation of the cushion structure **420** when the support base **400** is installed in a vehicle. In case the vehicle is subject to a sudden colliding force parallel to the lengthwise axis of the shell body **402** (e.g., when the collision occurs at the front of the vehicle), the inertia of the support base **400** and the seat installed thereon may cause the shell body **402** and the tubular anchor **410** to displace toward the front **402**F of the shell body **402** away from the attachment points of the latch assemblies **406** with the anchorage fixture of the vehicle. As a result, the rivet **428** affixed with each side segment **410**B can be urged to move relative to the extension **414** of the arm **404** from the hole **422** to the hole **424** through the cushioning portion **426**. Because the size of the slit **426**A is smaller than that of the rivet **428**, some frictional resistance can be generated against the displacement of the rivet **428** through the slit **426**A to dissipate the collision energy. This cushioned displacement of the shell body **402** and the tubular anchor **410** relative to the latch assemblies **406** can dissipate a part of the collision energy to reduce the risk of injury to the child.

In conjunction with FIGS. **11-14**, FIG. **18** is a schematic view illustrating an embodiment of a cushion structure **502** that can be used in replacement of the cushion structure **420** in the support base **400**, and FIG. **19** is a schematic view illustrating a cushion structure **502** disposed adjacent to a joint region of the tubular anchor **410** with the arm **404**. Each of the cushion structures **502** can be respectively disposed in the joint region between one side segment **410**B of the tubular anchor **410** and one extension **414** of the arm **404**. The cushion structure **502** can include the distal portion **414**A of the extension **414** having two spaced-apart holes **504** and **506** isolated from each other via a cushioning portion **502**A. The cushioning portion **502**A may be made of the same material of the extension **414** or arm **404**. The holes **504** and **506** may be distributed along an axis of insertion of the extension **414** through the side segment **410**B.

Once the extension **414** is put in place through the associated side segment **410**B, the hole **418** formed through the side segment **410**B can be aligned with the hole **504** of the extension **414**. A fastener such as rivet **508** then can be engaged through the hole **418** of the side segment **410**B and the hole **504** of the extension **414** to fixedly fasten the tubular anchor **410** with the arm **404**.

FIG. **20** is a schematic view illustrating exemplary operation of the cushion structure **502** when the support base **400** is installed in a vehicle. In case the vehicle is subject to a sudden colliding force parallel to the lengthwise axis of the shell body **402**, the inertia of the support base **400** and the seat installed thereon can cause the shell body **402** and the tubular anchor **410** to move toward the front **402**A away from the attachment points of the latch assemblies **406** with the anchorage fixture of the vehicle. As a result, the rivet **508** affixed with each side segment **410**B can be urged to break the cushioning portion **502**A of the extension **414** between the holes **504** and **506**, and move relative to the extension **414** from the hole **504** to the hole **506**. The break of the cushioning portion **502**A between the holes **504** and **506** may create a trench **510** in the extension **414** to dissipate collision energy. This cushioned displacement of the shell body **402** and the tubular anchor **410** relative to the latch assemblies **406** can dissipate a part of the collision energy to reduce the risk of injury to the child.

FIG. **21** is a schematic view illustrating another cushion structure **602** that can be used in replacement of the cushion structure **420** in the support base **400**, and FIG. **22** is a schematic view illustrating a cushion structure **602** disposed adjacent to a joint region of the tubular anchor **410** with the arm **404** in the support base. Each of the cushion structures **602** can be respectively disposed in the joint region between one side segment **410**B of the tubular anchor **410** and one extension **414** of the arm **404**. The cushion structure **602** can include the distal portion **414**A of the extension **414** having three spaced-apart holes **604**, **606** and **608**, and a slit **610**. The holes **604**, **606** and **608** and the slit **610** can be distributed along an axis of insertion of the extension **414** through the side segment **410**B, the hole **606** being located between the holes **604** and **608**. The slit **610** can be connected between the holes **606** and **608**, and the holes **604** and **606** can be isolated from each other via a solid sidewall of the extension **414**. In alternate embodiments, the holes **604** and **606** may also be connected with each other via a slit, or the holes **606** and **608** may be isolated from each other via a solid sidewall. Like previously described, the solid material of the extension **414** between the holes **604** and **606**, and between the holes **606** and **608** can form cushioning portions.

Once the extension **414** is put in place through the associated side segment **410**B, the hole **418** formed through the side segment **410**B can be aligned with the hole **604** of the extension **414**. A rivet **612** then can be engaged through the hole **418** of the side segment **410**B and the hole **604** of the extension **414** to fixedly fasten the tubular anchor **410** with the arm **404**.

In conjunction with FIG. **11**, FIG. **23** is a schematic view illustrating exemplary operation of the cushion structure **602** when the support base is installed in a vehicle. In case the vehicle is subject to a sudden colliding force parallel to the lengthwise axis of the shell body **402** (e.g., when the collision occurs at the front of the vehicle), the inertia of the support base and the seat installed thereon may cause the shell body **402** and the tubular anchor **410** to displace away from the arm **404**. As a result, the rivet **612** affixed with each side segment **410**B can be urged to break the solid material of the extension **414** between the holes **604** and **606** (which creates a trench **614**), and move from the hole **604** to the hole **606**.

In case the collision is stronger, the rivet **612** may move further from the hole **606** via the slit **610** to the hole **608** after breaking the material of the extension **414** between the holes **604** and **606**. Because the size of the slit **610** is smaller than that of the rivet **612**, some frictional resistance can be generated against the displacement of the rivet **612** through the slit **610** to dissipate collision energy. This gradual cushioned

displacement of the shell body **402** and the tubular anchor **410** relative to the latch assemblies **406** can dissipate a part of the collision energy to reduce the risk of injury to the child.

FIG. **24** is a perspective view illustrating another cushion structure **702** that can be used in the support base **400**, and FIG. **25** is a partially enlarged view illustrating a cushion structure **702** provided in the shell body **402** of the support base. In this embodiment, the extension **414** can include an elongated slot **704** having first and second ends **704**A and **704**B. Once the extension **414** is put in place through the associated side segment **410**B, a rivet **706** can be engaged through the side segment **410**B and guided through the slot **704** of the extension **414** to movably connect the tubular anchor **410** with the arm **404**.

The cushion structure **702** can include a cushioning pad **705** that is disposed in the base **402** at a position between the arm **404** and an inner sidewall of the shell body **402**. A plurality of ribs **708** can protrude from an inner sidewall of the shell body **402**, and engage with a plurality of mount slots **710** formed through the cushioning pad **705** to affix the cushioning pad **705** with the shell body **402**.

FIG. **26** is a perspective view of the cushioning pad **705**. The cushioning pad **705** can be made in a single piece made of cast aluminum. The mount slots **710** can be disposed on upper and lower edges of the cushioning pad **705**. The cushioning pad **705** can also include a plurality of elongated openings **712**A and circular openings **712**B. The elongated openings **712**A can be disposed adjacent to the mount slots **710** at the upper edge of the cushioning pad **705**, and the circular openings **712**B can be disposed adjacent to the mount slots **710** at the lower edge of the cushioning pad **705**.

FIG. **27** is a schematic view illustrating exemplary operation of the cushion structure **702** when the support base is installed in a vehicle. In case the vehicle is subject to a sudden colliding force parallel to the lengthwise axis of the shell body **402** (e.g., when the collision occurs at the front of the vehicle), the inertia of the support base **400** and the seat installed thereon may cause the shell body **402** and the tubular anchor **410** to displace away from the arm **404** and the latch assemblies **406** fixedly attached with the anchorage fixture of the vehicle. As a result, the rivet **706** affixed with each side segment **410**B can be urged to move along the slot **704** from the first end **704**A to the second end **704**B. Moreover, the tube portion **412**A of the transversal segment **412** can press against the cushioning pad **705** and causes its deformation. It is worth noting that the slot **704** and rivet **706** may be replaced with any of the cushion structures described previously in FIGS. **15** through **23** for use in combination with the cushioning pad **705**.

While the cushion structures have been described as being implemented in support bases, it will be appreciated that the cushion structures can also be formed with the seat body so that the seat body can be directly attached with the anchorage fixture of the vehicle. Alternatively, the support base and the seat portion may also formed in a unitary body.

The bases described herein can include cushion structures that can allow cushioned displacement of the shell body relative to the attachment points of the latch assemblies with the anchorage fixture of the vehicle. As a result, the cushion structures can absorb a part of the collision energy occurring during collision of the vehicle to reduce the risk of injury to the child.

Realizations of the support bases for child safety seats have been described in the context of particular embodiments. These embodiments are meant to be illustrative and not limiting. Many variations, modifications, additions, and improvements are possible. These and other variations, modifications, additions, and improvements may fall within the scope of the inventions as defined in the claims that follow.

What is claimed is:

1. A support base for a child safety seat, comprising:

a shell body having an inner sidewall, and an interior affixed with an anchor structure, the anchor structure including a side segment

an arm extending transversally relative to the shell body, the arm having a tube portion, and a rod arranged through the tube portion, the tube portion including an extension connected with the side segment of the anchor structure;

two latch assemblies respectively connected with a left and a right end of the rod, the latch assemblies being operable to fixedly attach the shell body with an anchorage fixture of a vehicle, and the rod being rotatable relative to the tube portion to turn the two latch assemblies to either of a storage state and a deployed state; and

a cushion structure arranged adjacent to a joint region where the side segment and the extension of the tube portion are connected with each other, wherein the cushion structure is operable to cushion a displacement of the shell body and the anchor structure relative to the arm and the latch assemblies when car collision occurs, the cushion structure including a first and a second hole formed through the extension, a cushioning portion formed from the material of the extension that is located between the first and second holes, and a fastener respectively engaged through the side segment and the first hole of the extension and in contact with the cushioning portion to fixedly fasten the anchor structure with the tube portion of the arm.

2. The support base according to claim **1**, wherein the cushioning portion includes a slit connecting with the first and second holes.

3. The support base according to claim **1**, further including a third hole disposed between the first and second hole, and a slit connecting with the second and third holes.

4. The support base according to claim **3**, wherein the first, second and third holes are substantially aligned with one another.

5. The support base according to claim **2**, wherein the slit is narrower than the first and second holes, and the first and second holes and the slit are distributed along an axis of insertion of the extension through the side segment.

6. The support base according to claim **1**, wherein the fastener breaks at least partially or causes deformation of the cushioning portion and moves relatively toward the second hole to cushion a displacement of the shell body and the anchor structure relative to the arm and the latch assemblies.

7. The support base according to claim **1**, wherein the anchor structure has a U-shape, and the arm is assembled with two distal ends of the anchor structure.

8. A child safety seat assembly comprising:

the support base according to claim **1**; and

a child safety seat arranged on the support base.

9. A support base for a child safety seat, comprising:

a shell body having an interior affixed with an anchor structure, the anchor structure including two side segments;

an arm extending transversally relative to the shell body, the arm having a tube portion, and a rod pivotally supported through the tube portion, the tube portion including two extensions projecting from an outer surface of the tube portion that are respectively fastened with the two side segments of the anchor structure;

two latch assemblies respectively connected with a left and a right end of the rod, the latch assemblies being operable to fixedly attach the shell body with an anchorage fixture of a vehicle, and the rod being rotatable with the two latch assemblies relative to the tube portion and the anchor structure; and

two cushion structures interacting with the arm to cushion a displacement of the shell body and the anchor structure relative to the arm and the latch assemblies when car collision occurs.

10. The support base according to claim **9**, wherein the two cushion structures are respectively arranged adjacent to two joint regions where the two side segments and the two extensions of the tube portion are respectively fastened with each other.

11. The support base according to claim **10**, wherein each of the cushion structures respectively includes a first and a second hole formed through the corresponding extension, a cushioning portion formed from the material of the extension that is located between the first and second holes, and a fastener respectively engaged through the corresponding side segment and the first hole of the extension and in contact with the cushioning portion to fixedly fasten the anchor structure with the tube portion of the arm.

12. The support base according to claim **11**, wherein the fastener breaks at least partially or causes deformation of the cushioning portion and moves relatively toward the second hole to cushion a displacement of the shell body and the anchor structure relative to the arm and the latch assemblies.

13. A support base for a child safety seat, comprising:

a shell body having an interior affixed with an anchor structure, the anchor structure including two side segments;

an arm extending transversally relative to the shell body, the arm having a tube portion, and a rod pivotally supported through the tube portion, the tube portion including two extensions that are respectively fastened with the two side segments of the anchor structure;

two latch assemblies respectively connected with a left and a right end of the rod, the latch assemblies being operable to fixedly attach the shell body with an anchorage fixture of a vehicle, and the rod being rotatable with the two latch assemblies relative to the tube portion and the anchor structure; and

two cushion structures respectively disposed adjacent to the two extensions of the tube portion, the two cushion structures being configured to cushion a displacement of the shell body and the anchor structure relative to the arm and the latch assemblies when car collision occurs.

14. The support base according to claim **13**, wherein the two cushion structures are respectively arranged adjacent to two joint regions where the two side segments and the two extensions of the tube portion are respectively fastened with each other.

15. The support base according to claim **13**, wherein at least one of the two cushion structures includes a first and a second hole formed through the corresponding extension, a cushioning portion formed from the material of the extension that is located between the first and second holes, and a fastener respectively engaged through the corresponding side segment and the first hole of the extension and in contact with the cushioning portion to fixedly fasten the anchor structure with the tube portion of the arm.

16. The support base according to claim **15**, wherein the fastener breaks at least partially or causes deformation of the cushioning portion and moves relatively toward the second hole to cushion a displacement of the shell body and the anchor structure relative to the arm and the latch assemblies.

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